

INTRODUCTION

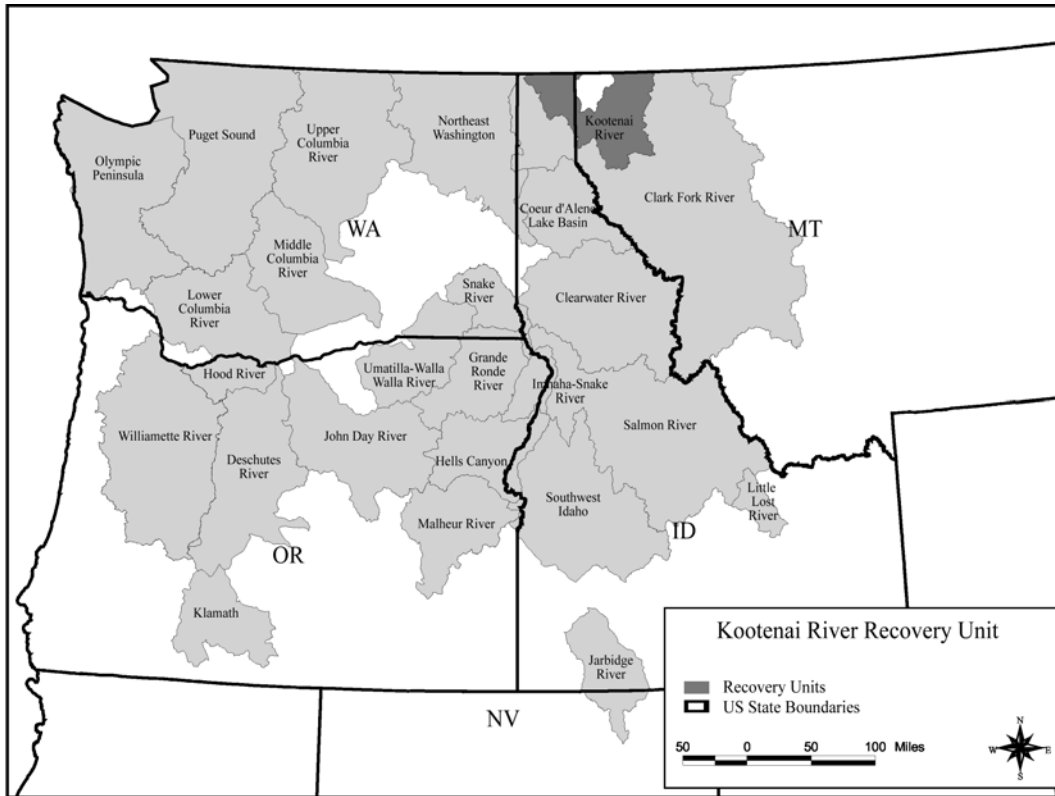
Recovery Unit Designation

The Kootenai River is 1 of 22 recovery units designated for bull trout in the Columbia River basin (Figure 1). The Kootenai River has a unique international flow pattern. From the headwaters, entirely in British Columbia, the Kootenai River (spelled “Kootenay” in Canada) flows south into the United States in northwestern Montana. The stream turns abruptly west into northern Idaho and then north again to return to British Columbia, where it eventually joins with the upper Columbia River system. A simple schematic to visualize is a horseshoe, with the right arm the British Columbia headwaters, the bottom of the horseshoe in northwestern Montana and northern Idaho, and the left arm in the lower Kootenai River and Kootenay Lake in British Columbia (Figure 2).

The Kootenai River watershed was historically isolated from two-way fish passage with the Columbia River by Bonnington Falls, a major fish barrier located on the Kootenay River in British Columbia. The falls are just a few kilometers upstream of the confluence with the Columbia River, on the reach of the river downstream of Kootenay Lake. A second major series of falls, Kootenai Falls, are located in northwest Montana some 22 River kilometers (13.7 River Miles) upstream of the Idaho border. The historical importance of Kootenai Falls as a barrier to fish movement is unknown, although recent radio telemetry information indicates that this series of falls is traversed by adult bull trout at certain flows.

The Kootenai River Recovery Unit Chapter of the Bull Trout Recovery Plan focuses on the portions of the Kootenai River watershed within the United States. But due to the international configuration of the basin, strong transboundary coordination is necessary for recovery to occur.

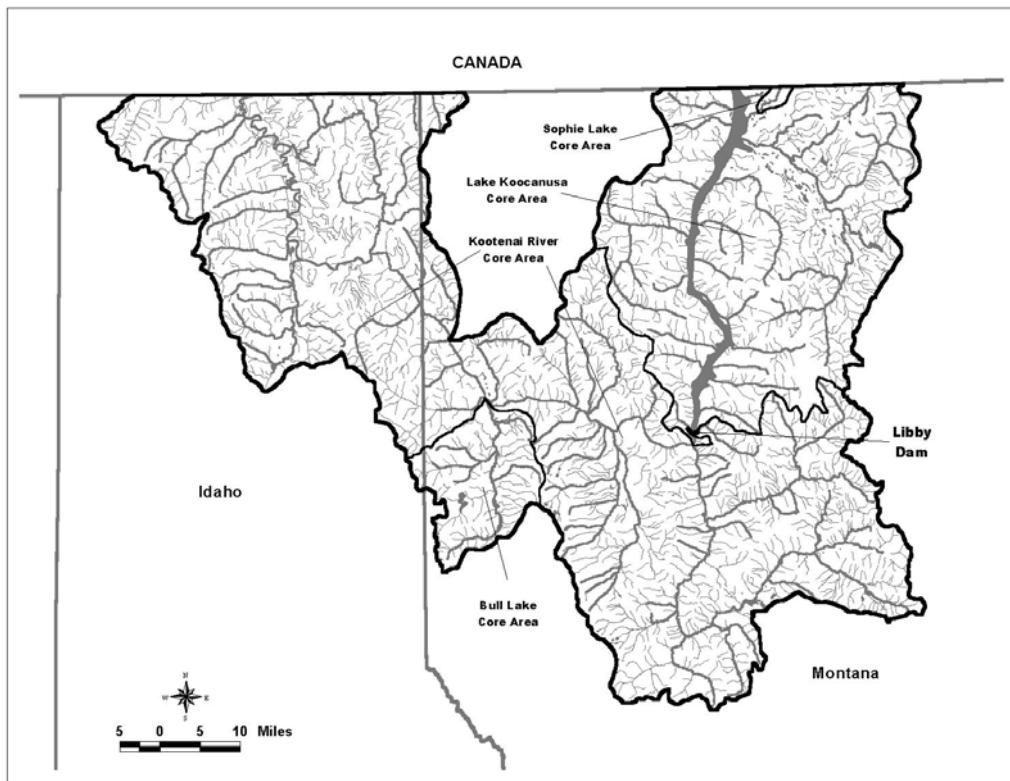
Figure 1. Bull trout recovery units in the United States. The Kootenai River Recovery Unit is highlighted.



Geographic Description

Over two-thirds of the Kootenai River drainage lies within the Province of British Columbia, Canada. The Kootenai River is the second largest tributary to the Columbia River and has an average annual flow of 400.5 cubic meters per second (14,150 cubic feet per second), as measured near the Montana/Idaho border (USGS 1999). The total drainage area of the Kootenai River within the recovery unit boundaries in the United States is about 36,000 square kilometers (14,000 square miles), about 80 percent of which is in Montana and 20 percent in Idaho.

Figure 2. Map of core areas in the Kootenai River Recovery Unit.



The climate in northwestern Montana and northern Idaho is dominated by maritime weather patterns, characteristic of much of the Pacific Northwest. Generally, cloudy, cool, and wet weather occurs in winter, often with steady, soaking rains and wet snows. In fall and winter, the area is often (every 6 to 10 years) influenced by “rain on snow” events that sometimes result in higher stream flows than occur during spring runoff (PBTAT 1998). Precipitation within the basin ranges from 35 centimeters (14 inches) to over 305 centimeters (120 inches) at the highest elevations, with the average for the area being about 76 centimeters (30 inches). About 70 percent of the annual precipitation falls as snow.

The Kootenai River basin remains sparsely populated. Fewer than 100,000 people live within the drainage upstream of Kootenay Lake. About 90 percent of the Kootenai watershed is coniferous forest. A small amount is agricultural land, used mainly for pasture and forage production (Marotz *et al.* 1988). The forest products industry is the dominant industrial activity in the

Kootenai River basin. About 80 percent of the commercial timberland in the Kootenai River drainage within the United States is owned and managed by the Federal government (Kootenai and Idaho Panhandle National Forests).

The river originates in Kootenay National Park (near Banff, British Columbia) and enters Lake Koocanusa 68 kilometers (42 miles) north of the Montana border, at an elevation of about 704 meters (2,310 feet) mean sea level. Libby Dam, which created Lake Koocanusa in 1972, is located 27 kilometers (17 miles) upstream of Libby, Montana (MBTSG 1996a). Downstream of the dam, the river turns northwest and crosses the Montana/Idaho border near Troy, Montana, at the lowest elevation point in Montana (555 meters [1,820 feet] mean sea level). The river continues northwest across the Idaho panhandle and leaves the United States, reentering British Columbia just upstream of Kootenay Lake, at an elevation of 533 meters (1,750 feet) mean sea level.

Lake Koocanusa (Libby Reservoir) was created under an International Columbia River Treaty between the United States and Canada for cooperative water development of the Columbia River basin. The authorized purpose of Libby Dam is to provide power, flood control, navigation, and other benefits.

At full pool, Lake Koocanusa is 145 kilometers (90 miles) long and 188 square kilometers (46,500 acres) in surface size, with almost half its length in British Columbia. At minimum pool, the reservoir is 59 square kilometers (14,500 acres). Maximum depth of the reservoir is 107 meters (350 feet) (MBTSG 1996c). Partially as a result of changes caused by the dam, Kootenai River white sturgeon (known only to inhabit the drainage downstream of Kootenai Falls) have experienced chronic reproductive failure (USFWS 1999). They were listed as an endangered species in 1994. Burbot populations in the Kootenai River have also declined markedly (Paragamian *et al.* 2000). Habitat impacts and overfishing have also been contributing factors in these declines.

The lower Kootenai River (for our purposes considered to be the portion of the watershed downstream of Libby Dam in Montana and Idaho) can be divided into two subreaches with different characteristics (PBTAT 1998). The underlying bedrock of the Kootenai River drainage downstream of Libby Dam consists primarily of belt series rock. Intrusions of igneous rock are scattered throughout the area, which has been highly influenced by glacial activity from both continental ice masses and alpine glaciation. The

Kootenai River, flowing from Libby Dam over Kootenai Falls and for a total of about 129 kilometers (80 miles) to Bonners Ferry, Idaho, is free-flowing. It is mostly constricted in a single channel located in a narrow canyon. This portion of the river has a substrate of gravel to large rubble, with some deep pools and bedrock shelves.

Downstream of the canyon, the character of the river changes dramatically. Immediately upstream of Bonners Ferry, there is a braided depositional zone extending nearly 10 kilometers (about 6 miles) (PBTTAT 1998). The lower 76 kilometers (47 miles) of the Kootenai River within the United States meanders through the fertile Kootenai River bottomlands from Bonners Ferry to the international border. The water level is influenced by the elevation of Kootenay Lake in British Columbia, resulting in a relatively flat, slow-moving river with holes up to 30.5 meters (100 feet) deep. Because the floodplain is aggressively diked to protect agricultural lands, the natural pattern and flow regime of the valley bottom streams have been impacted. Many of the tributary streams that enter the Idaho section of the Kootenai River flow from hanging valleys over bedrock controls, with steep sections and impassable barriers. River substrate is primarily sand, silt, and clay. The river continues in this fashion for another 50 kilometers (31.05 miles) in British Columbia, to its confluence with the southern arm of Kootenay Lake.

DISTRIBUTION AND ABUNDANCE

Status of Bull Trout at the Time of Listing

In the final listing rule, five subpopulations of bull trout were recognized within the Kootenai River basin (USFWS 1998). These included three portions of the mainstem system: (1) Upper, upstream of Libby Dam, (2) Middle, from Libby Dam downstream to Kootenai Falls, and (3) Lower, downstream of Kootenai Falls through Idaho to the United States/Canada border. The two disconnected subpopulations (referred to as disjunct by the Montana Bull Trout Scientific Group), in Bull Lake (MBTSG 1996b) and Sophie Lake (MBTSG 1996c), were considered separate subpopulations. At the time of listing, all Kootenai River bull trout subpopulations were considered to have unknown status and population trend, and the Sophie Lake subpopulation was considered to be at risk of stochastic extirpation due to its single spawning stream and small population size.

In the final listing rule, the greatest threats to bull trout were identified as forestry, dams, mining and associated water quality impacts, introduced species, and residential development. The magnitude of threats was rated high for the Middle Kootenai subpopulation (between Libby Dam and Kootenai Falls) and moderate for the other four subpopulations. In all five subpopulations, the threats were considered imminent.

The best scientific evidence available indicates that the subpopulation groups we described in the listing rule are each comprised of one to many local populations. This recovery chapter will address recovery actions and analysis by core areas and their local populations, rather than refer to subpopulation groups.

Current Distribution and Abundance

Bull trout are one of six native salmonid species distributed throughout the Kootenai River drainage. Other native salmonids include westslope cutthroat trout; redband trout, of which there are two strains ("Gerrards," which grow very large and are piscivorous, and "residents," which are small and inhabit headwater streams); pygmy whitefish; and mountain whitefish (see Appendix A for a complete list of fish species

found in the recovery unit). Kokanee are also native to Kootenay Lake, and they spawned historically in some tributaries in Idaho, and perhaps Montana. The native salmonids share these waters with the Kootenai River population of white sturgeon, which was listed as endangered in 1994 under the Endangered Species Act.

It is not known whether Kootenai Falls was historically an upstream migration barrier to bull trout prior to the construction of Libby Dam. Speculation was that high spring flows may have allowed seasonal fish passage. Local bull trout populations in the Kootenai River downstream of Kootenai Falls were believed to include migratory adfluvial fish from Kootenay Lake in British Columbia, as well as fluvial Kootenai River fish that may have moved freely throughout the drainage. Recent evidence, collected by radio telemetry studies, indicates that bull trout can and do surmount the falls. This ability suggests that local populations of bull trout downstream of Libby Dam should all be considered one interconnected unit, and we have treated this area as one core area in this recovery plan (Figure 2). Resident bull trout may have been present historically in some drainages, and resident bull trout now occur in Libby Creek and possibly other sites.

Distribution of bull trout in the Kootenai River Recovery Unit has changed little since the listing occurred. Bull trout continue to be present in nearly all major watersheds in this recovery unit where they likely occurred historically. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), the fish are not expected to simultaneously occupy all available habitats (Rieman *et al.* 1997). Most distribution gaps probably reflect natural conditions.

In recent years, emphasis for the Kootenai River basin has been placed on documenting distribution and determining abundance through the use of redd counts. Because of the large size of the migratory fish and the geology of the streams (which generally makes the redds easy to recognize), redd counts (Spalding 1997) have been shown to provide a repeatable method of indexing spawner escapement in many streams in this recovery unit (Rieman and McIntyre 1996). However, several authors have cautioned that redd counts should not be relied upon as the sole method of population monitoring (Rieman and Myers 1997, Maxell 1999) and may, in fact, lead to erroneous conclusions about population status and trend.

Table 1 summarizes the recent status of redd count information for the four core areas in this recovery unit. Redd counts represent an unknown but substantial portion of the possible spawning population. Three of the four core areas have an established history of redd count trend information for migratory fish. Six streams in the United States and three in Canada are now being monitored, with index redd counts conducted on an annual basis. Redd counts have traditionally been conducted only for migratory fish. In some drainages, there are likely to be additional resident bull trout spawners whose redds are smaller than those of migratory fish, therefore difficult to identify. They have not been included in these totals. On the Wigwam River, five permanent monitoring sites were established in 2000 to evaluate juvenile abundance (Cope and Morris 2001), but only sporadic estimates of juvenile abundance have been obtained elsewhere in the basin.

Table 1. Summary of redd count information for migratory adults in the four bull trout core areas in the Kootenai River Recovery Unit.

Core Area Name	Drainage Basin (approx. square kilometers)	# of Local Populations Monitored	Mean Total # of Redds Counted (1996-2000)
Lake Koocanusa (Upper Kootenai)	270 (United States only)	2 (1 in Canada)	848
Kootenay Lake and River (Lower Kootenai)	1,230 (United States only)	4	165
Sophie Lake	12	0	----
Bull Lake	130	1	83

Lake Koocanusa Core Area

Adult bull trout reach large sizes in Lake Koocanusa. Researchers noted higher growth in bull trout through age four in Lake Koocanusa than for bull trout from Flathead Lake and Hungry Horse Reservoir (MBTSG 1996c). Radio telemetry studies involving 36 adult bull trout surgically implanted with tags at the Wigwam River weir in 1996 to 1998 showed that postspawning adult fish generally wintered in Lake Koocanusa in Montana (Baxter and Westover 2000). Before making the spawning run in the

Kootenay River, the fish gathered off the mouth of the Elk River during late May and early June. Between mid-June and mid-July, most were in the lower reaches of the Elk River, and by the end of July they entered the Wigwam River. Spawning peaked the last week of September, and adults were back in the Kootenay River or Lake Koocanusa by the end of October (Baxter and Westover 2000).

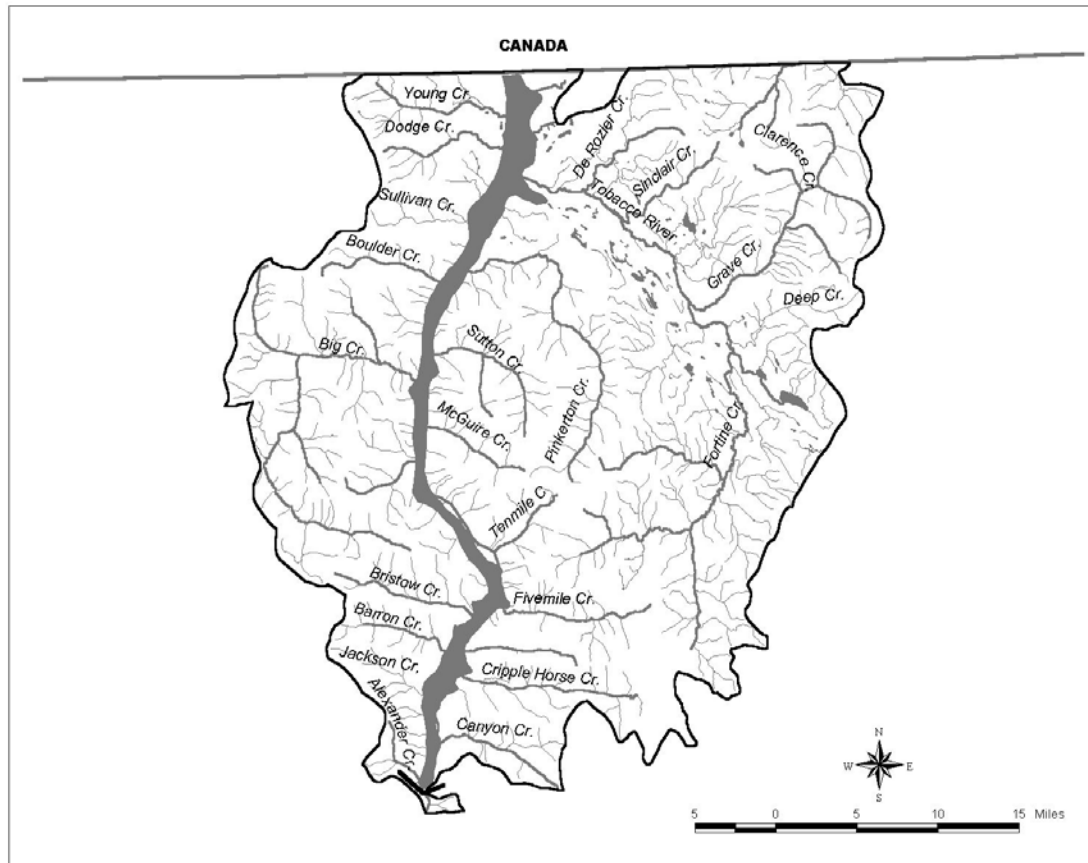
Relatively little trend data for bull trout populations is available for the upper Kootenai River drainage. Efforts to assess local population status were first initiated in the United States in 1983, but were not conducted continuously until recent years. Surveys in British Columbia's Wigwam River drainage began in 1978, but were also sporadic until recently. Gill netting trend data from Lake Koocanusa suggests that the bull trout populations may be stable or increasing.

Upstream of Libby Dam, bull trout from Lake Koocanusa also utilize the Grave Creek drainage in the United States for spawning and rearing (Figure 3). The Tobacco River provides the migration corridor between the reservoir and Grave Creek. The redd count information presently available for Grave Creek is insufficient to make conclusions regarding trends.

Redd searches have been conducted on other Lake Koocanusa tributaries in the United States, including Five Mile, Cripple Horse, Bristol, Warland, Williams, Lewis, Stahl, and Barron creeks. Field crews have not found redds, and bull trout presence in these and other United States tributaries is described as “incidental” (MBTSG 1996c).

In 1978, British Columbia Ministry of Water, Land, and Air Protection first monitored spawning bull trout in the upper Wigwam River and Bighorn (Ram) Creek, using migrant traps (Oliver 1979). Between July and October 1978, 515 adult bull trout passed upstream through the traps. During the next survey, in 1995, 247 bull trout redds were identified on the Wigwam River system in British Columbia.

Figure 3. Map of Lake Koocanusa core area showing watersheds and major features.



Since 1995, a trapping study has indicated that the numbers of bull trout that spawn in the Wigwam River are increasing. Baxter *et al.* (2000) reported the capture of between 616 and 978 adult bull trout annually during 1996 to 1999 at a weir on the Wigwam River. The weir was operated to catch migrating and post-spawning adults in the fall. Due to the location of the weir, these counts represent only a portion of the total numbers of fish using that drainage. Ground surveys conducted in 1994 to 2001 found increasing numbers of bull trout redds in the Wigwam River drainage (nearly all in British Columbia, but a few in the headwaters in Montana), with a peak count of 1,195 redds in 2000 (Baxter *et al.* 2000; Westover, *in litt.*, 2001a), exceeded again by a count of 1,496 redds in 2001 (Westover, *in litt.*, 2001b). Baxter and Westover (2000) state that

the Wigwam River is arguably “the most prolific bull trout population in the species distributional range.”

Spawning by migratory bull trout is also known to occur in British Columbia in several upper Kootenay River tributaries, including Gold Creek, Bull River, St. Mary River, Skookumchuck Creek, Lussier River, White River, Kikomun Creek, and Findlay Creek (B. Westover, British Columbia Ministry of Water, Land, and Air Protection, pers. comm., 2001). Numbers of fish and location of spawning activity in these drainages are currently being examined. A study is underway using radio telemetry to find other spawning concentrations and track movements (Westover, *in litt.*, 1999). In Skookumchuck Creek, 66 bull trout redds were located in 1997, 105 redds in 1998, 161 in 1999, 189 in 2000 (Baxter and Baxter 2001), and 132 in 2001 (Westover, *in litt.*, 2001b). During fall 2000, the White River was counted for the first time and 67 redds were located (Westover, *in litt.*, 2001b). More information is needed to determine whether these migratory fish are primarily fluvial or adfluvial (from Lake Koocanusa).

Five permanent juvenile bull trout monitoring sites were established in the Wigwam River basin in 2000. Bull trout represented 92.4 percent of the catch, and the mean density of juvenile bull trout was estimated to be 17.2 fish per 100 square meters, indicating a very high population density for this species (Cope and Morris 2001).

Kootenai River / Kootenay Lake Core Area

Bull trout are widely distributed through the lower Kootenai River, from Libby Dam downstream to Kootenay Lake in British Columbia. Spawning and rearing by migratory adults occur in tributaries draining portions of British Columbia, Idaho, and Montana (Figure 4). These migratory fish spend their adult lives in Kootenay Lake or the Kootenai River. Libby Dam is an impassable barrier to upstream migration.

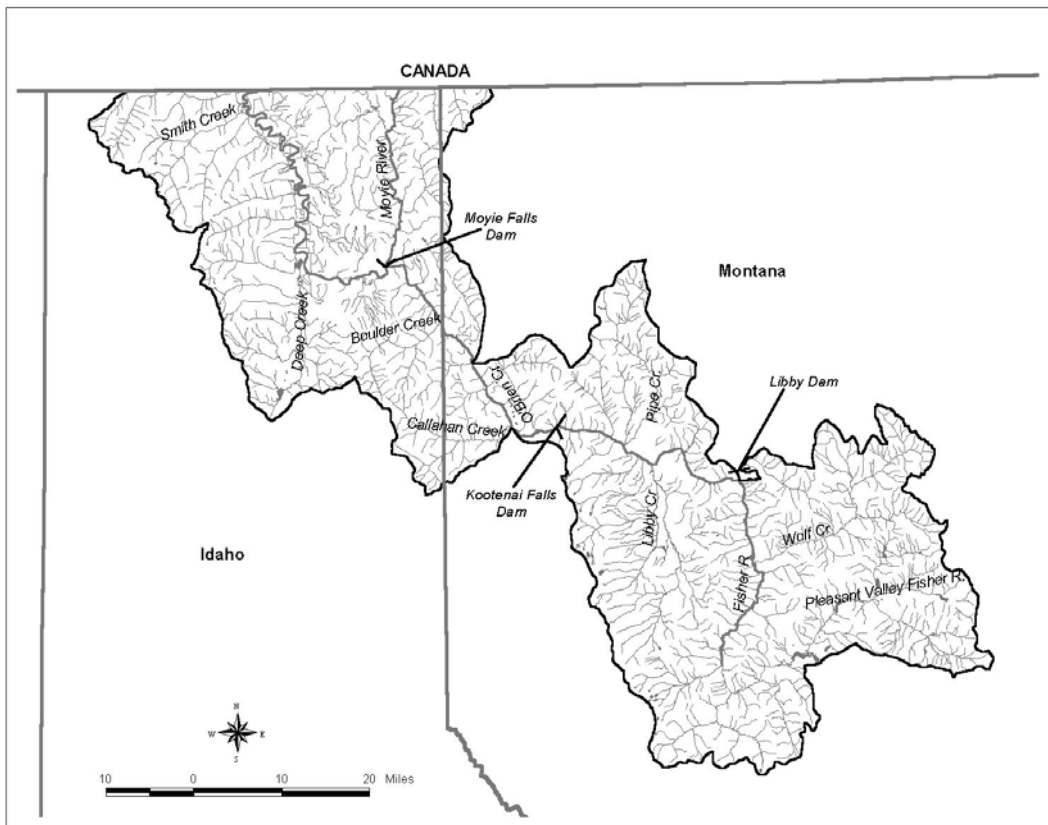
Spawning and rearing of migratory bull trout have been documented in four tributaries of the Kootenai River between Libby Dam and Kootenai Falls (Quartz, Pipe, and Libby creeks and Fisher River; see Figure 4). These migratory fish spend their adult lives in the Kootenai River or Kootenay Lake. Tagging studies had previously confirmed that fish from above the falls sometimes moved

downstream over Kootenai Falls (Marotz *et al.* 1988). As previously mentioned, recent telemetry information suggests these fish have two-way access over Kootenai Falls.

The most heavily used spawning and rearing stream for bull trout between Kootenai Falls and Libby Dam is in the Quartz Creek drainage (MBTSG 1996a). Between 1994 and 2000, this drainage supported from 47 to 105 redds annually. Most of the redds were observed in the West Fork of Quartz Creek. The remaining redds were observed in Quartz Creek downstream of the confluence with the West Fork.

Personnel from Montana Fish, Wildlife and Parks and the Kootenai National Forest have conducted inventories of bull trout spawning sites on several other

Figure 4. Map of Kootenai River/Kootenay Lake core area showing watersheds and major features.



tributaries to the Kootenai River between Libby Dam and Kootenai Falls. These include Pipe, Granite, Libby, Midas, and Dunn creeks and the Fisher River drainage. Pipe Creek (5 to 36 redds in 1991 to 2000) and Libby Creek (10 to 36 redds in 1996 to 2000) support annual bull trout spawning. Resident bull trout are also suspected to be present in tributaries to Libby Creek, such as Big Cherry Creek. During the late 1980's, several tributaries of Libby Creek were sampled, and bull trout were found in Poorman Creek and Ramsey Creek, but not in Little Cherry Creek (MBTSG 1996a).

In the Fisher River, low numbers of adult migratory bull trout have been documented (MBTSG 1996a). In 1993, redd counts were completed on 13 streams in the Fisher River drainage. A total of 13 suspected bull trout redds were observed (4 in the East Fisher River, 8 in Silver Butte Fisher River, and 1 in the Fisher River). In 1999, 18 redds were found in West Fisher Creek, and 23 were counted there in 2000. The majority of streams surveyed contained potential obstacles to fish passage (including beaver dams, log jams, and falls), and few suitable spawning sites exist due to the high gradient, the large streambed substrate, low pool/riffle ratio, and subterranean water flow.

The strongest spawning and rearing stream in the Montana portion of the Kootenai River downstream of Kootenai Falls is O'Brien Creek (MBTSG 1996b). From June to September 1992, the Montana Fish, Wildlife and Parks operated an upstream trap in O'Brien Creek. During this period, 20 adult bull trout were captured in the trap. Because of the relatively large size of adults captured (up to 76 centimeters [30 inches]), these fish were probably migrants from the Kootenai River or Kootenay Lake (MBTSG 1996b). Since 1992, spawning site inventories have been completed annually in O'Brien Creek, and 12 to 47 redds have been counted (MFWP, *in litt.*, 2002). Resident bull trout are also suspected to occur in O'Brien Creek, but have not been confirmed. Brook trout are present in O'Brien Creek, and 87 probable brook trout redds (species determination was based on size, timing, and observation of fish on redds) were recorded in 1994 (MBTSG 1996b). Brook trout hybridization with bull trout is suspected in O'Brien Creek.

During 1992, Montana Fish, Wildlife and Parks conducted redd searches in several other Montana tributaries to the Kootenai River below Kootenai Falls, including Callahan, Ruby, and Star creeks and the Yaak River. Field crews found no redds in the Yaak River, from its junction with the Kootenai River to Yaak Falls, a barrier falls located approximately 11 kilometers (7 miles) upstream (MBTSG 1996b). The channel through this area is high gradient and comprised of large substrate. The Yaak River is a large system with average discharges around 4.25 to 5.66 cubic meters per second (150 to 200 cubic feet per second) during August through October. Because of the substrate composition and the size of the stream, redds may be hard to detect. Low numbers of small bull trout were present during electrofishing surveys downstream of Yaak Falls. Additional survey work is needed to determine potential bull trout utilization of the Yaak River below the falls. Extensive sampling upstream of Yaak Falls has failed to document the presence of bull trout in the United States (MBTSG 1996b).

No redds were found in 14.5 kilometers (9 miles) of Callahan Creek surveyed during 1992 (MBTSG 1996b). This portion of Callahan Creek is a high-gradient stream with large substrate. Since only the lower 14.5 kilometers (9 miles) have been surveyed for bull trout redds, and that during a single year, we cannot conclude that spawning by migratory bull trout does not occur. Historical anecdotal information suggests that adult bull trout were illegally harvested with weirs in Callahan Creek (MBTSG 1996b). Juvenile bull trout have been observed in low numbers during electrofishing surveys. Ruby and Star creeks do not appear to be suitable for spawning, and no redds have been found, but juvenile bull trout occur in low numbers. Bull trout spawning in the mainstem Kootenai River has not been documented at this time and probably does not occur due to habitat and thermal conditions.

The Idaho Department of Fish and Game is currently conducting research on bull trout distribution and movements. Bull trout have been documented in the Idaho portion of the basin in the Kootenai and Moyie Rivers and Callahan, Curley, Deer, Deep, Fall, Caribou, Snow, Myrtle, Rock, Trout, Parker, Long Canyon, and Boundary creeks (PBTTAT 1998). Additional observations of bull trout were reported in Boulder, Caboose, and Debt creeks in Idaho, just downstream of the Montana border (Walters, *in litt.*, 2001). Typically, sightings of bull trout in Idaho waters have been

limited to individual fish. Adult bull trout appear to be well distributed throughout the Kootenai River in Idaho, but at very low densities as noted in the extensive electrofishing record on the Kootenai River. Radio telemetry data indicates that some of those fish overwinter in the deep holes of the lower river (Walters, *in litt.*, 2001). Five of eight adult bull trout radio-tagged in O'Brien Creek in Montana migrated downstream into Idaho following spawning.

Also, there is evidence that some bull trout sampled in Idaho are migrants from Kootenay Lake, British Columbia. At least two fish tagged in British Columbia have been relocated in Idaho, as far upstream as the Moyie River (Walters, *in litt.*, 2001). Very limited information is available regarding abundance and life history attributes in these waters. The valleys of the lower Kootenai were developed for agriculture in the late 19th and early 20th century, and the habitat for bull trout was negatively impacted prior to the collection of substantive fishery data. The historic distribution and abundance of bull trout in the Idaho portion of the watershed are not well known.

In recent years, extensive fish population sampling in the Idaho waters of the Kootenai River basin has found no indication of reproducing local populations of bull trout in any Idaho tributaries (PBTAT 1998). In the fall of 1999 and 2000, redd surveys in Idaho tributaries did not locate any confirmed spawning locations (Walters, *in litt.*, 2001). Among tributaries deemed to have potential for bull trout spawning, natural barrier waterfalls limit access to only the lower portions of all but Boundary, Deep, Long Canyon, and Callahan creeks. Juvenile bull trout less than 100 millimeters (3.9 inches) long have been occasionally documented in the Kootenai River in Idaho, but may have originated from upstream sources in Montana (Walters, *in litt.*, 2001).

Bull Lake and Sophie Lake Core Areas

Bull Lake, a natural lake in the headwaters of the Lake Creek drainage, is a bull trout secondary core area (Figure 5). In 1917, Troy Dam (also called Northern Lights Electric Company Dam) was constructed on Lake Creek, about 24 kilometers (15 miles) downstream of Bull Lake (MBTSG 1996b). It is believed that migration of bull trout over a natural barrier at the dam site was difficult or impossible prior to this dam. The dam is currently an upstream passage barrier. The local population(s) of bull trout in Bull Lake is unusual in that the adult spawners run downstream of Bull Lake, using

Lake Creek as a corridor to access spawning areas in Keeler Creek. This pattern of downstream spawning migration has also been observed in the Flathead River drainage (Upper Kintla Lake and Cyclone Lake) but is considered rare across the range of bull trout. Trapping of Keeler Creek in 1977 resulted in the collection of migrating adult bull trout during June to October (Marotz *et al.* 1988).

Sophie Lake contains a small and disjunct bull trout secondary core area in a closed basin (Figure 6). There is no historical record of bull trout stocking or transplant to this water, but because of the closed nature of this basin, these fish could have been artificially introduced early in the 20th century. A genetic survey may be enlightening. Though this population is currently considered to reside in a secondary core area, that classification will be reviewed. An ultimate determination of the recovery classification for this population represents a research need.

Bull trout reach maturity in Sophie Lake, with a single spawning and rearing area in Phillips Creek (MBTSG 1996c). Phillips Creek headwaters are in British Columbia, and Phillips Creek flows through private timberland that has substantial logging history and road development in the upper reaches. About 3 kilometers (2 miles) north of the United States/Canada border, Phillips Creek drops over a large (120 meters) series of falls and cascades (a complete natural barrier) and then proceeds south across the border. In the United States, the river continues south for another 5 kilometers (3.5 miles) across private land before terminating at Sophie Lake. This lake has intermittent drainage to Lake Koocanusa, which lies just 1.5 kilometers (1 mile) to the west, but the two lakes are probably not sufficiently connected for fish passage to occur. Water is withdrawn from Phillips Creek upstream of the barrier falls (in British Columbia) for power production, and Phillips Creek is heavily dewatered for irrigation purposes in both the United States and Canada. In most years, the stream is dewatered trout

Figure 5. Map of Bull Lake secondary core area showing watersheds and major features.

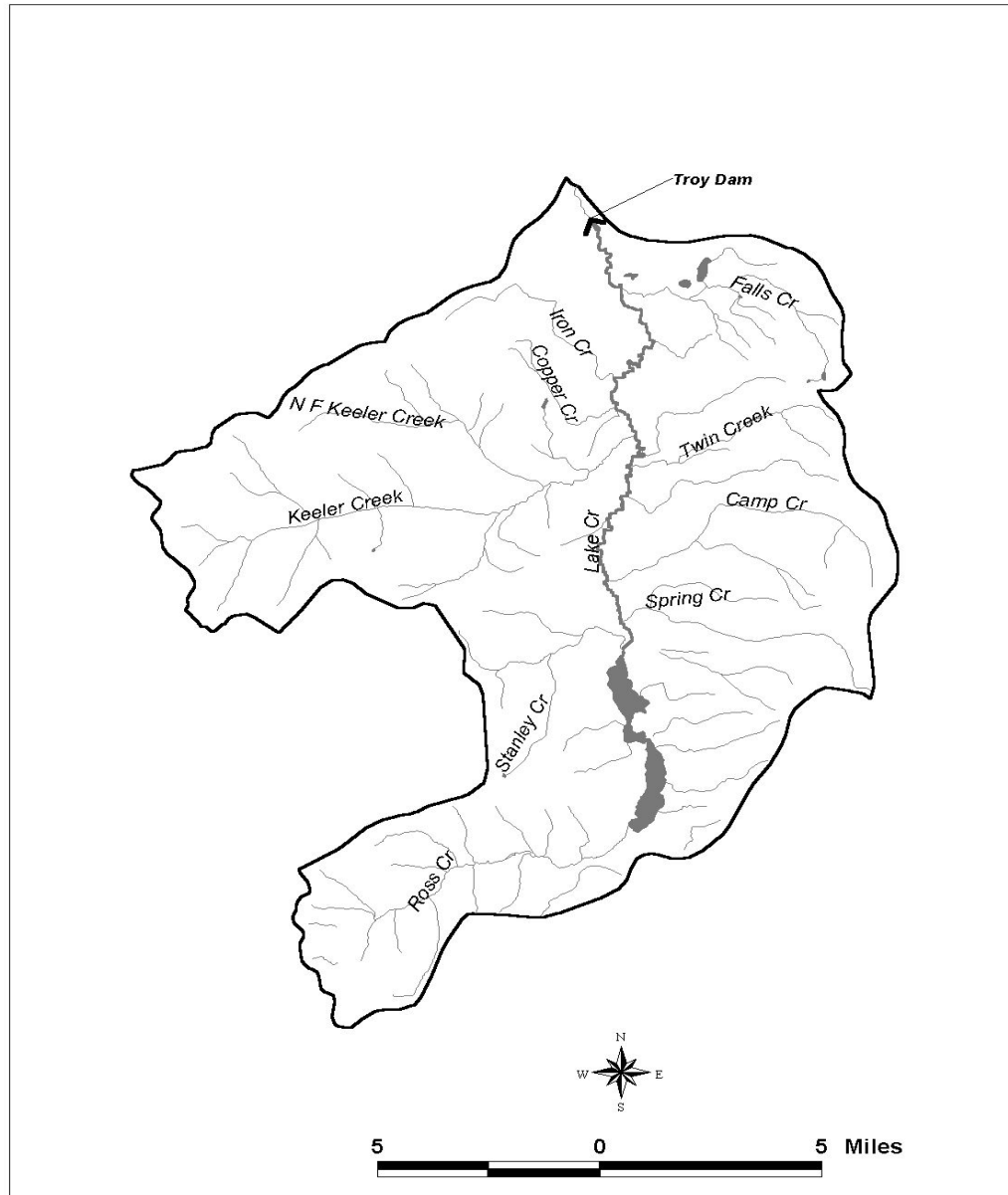
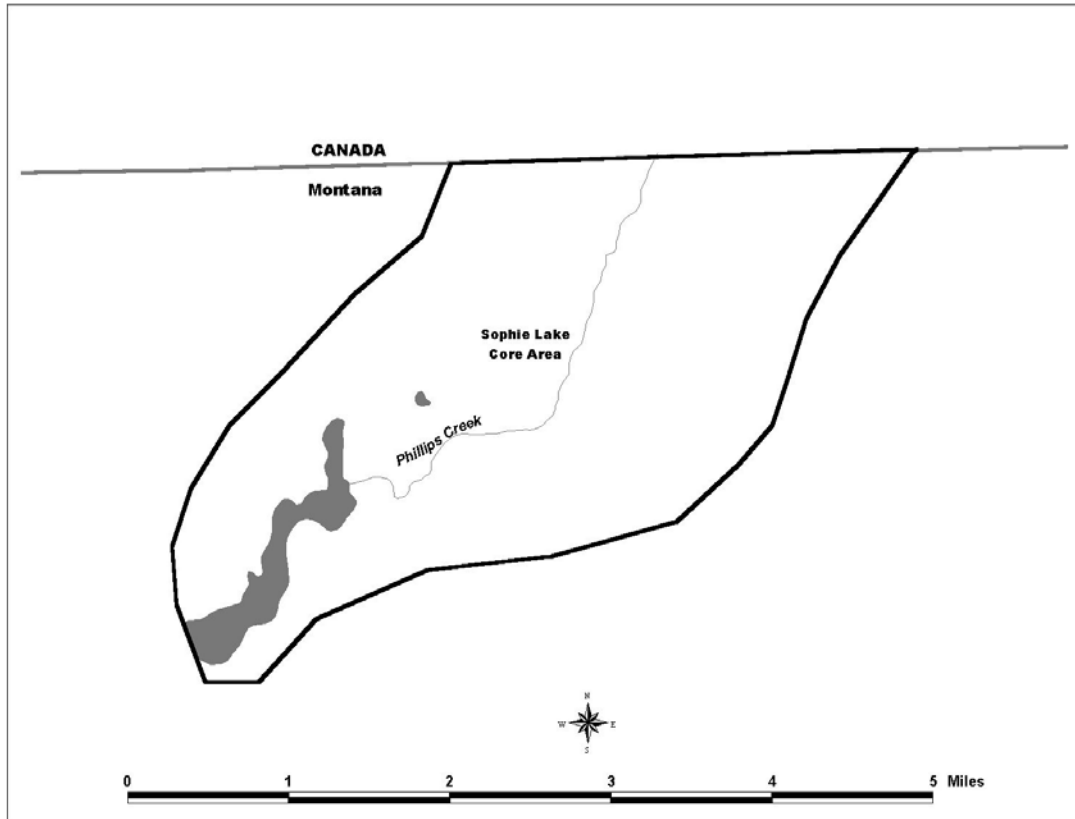


Figure 6. Map of Sophie Lake secondary core area showing watersheds and major features.



(70 to 182 millimeters) were sampled just north of the border by survey crews of the British Columbia Ministry of Water, Land, and Air Protection (Westover, *in litt.*, 1999), but bull trout are not known to exist in the stream system upstream of the falls. The U.S. Fish and Wildlife Service Partners For Fish and Wildlife program is working to improve habitat in the degraded lower reaches of the stream.

Bull trout are also present in Glen Lake, but they are probably not reproducing in this system. The fish access Glen Lake as juveniles outmigrating from Grave Creek via the Glen Lake ditch (MBTSG 1996c). Bull trout that mature in Glen Lake cannot return to Grave Creek because of a migration barrier in the ditch. These fish are essentially lost from the Lake Kootenai core area. In 2001, a project was completed to screen this ditch and improve fish passage over the dam on Grave Creek.

REASONS FOR BULL TROUT DECLINE

Dams

In Lake Koocanusa (the reservoir behind Libby Dam), drawdown limits to protect fishery resources have been advocated since at least 1987 (MBTSG 1996c). In the late 1980's and early 1990's, proposed drawdown limits were exceeded over half the years. Extreme drawdowns have been shown to have negative consequences on benthic insect production, zooplankton production, and terrestrial insect deposition (MFWP 1997). There is concern about the long-term maintenance of fisheries in Lake Koocanusa, given the continuing operational fluctuation (MFWP 1997).

Entrainment studies at Libby Dam have documented low numbers of bull trout passing through the dam, primarily in the spring. Skaar *et al.* (1996) found a total of 6 bull trout in a sample of 13,186 entrained fish captured below the dam. They estimated that the total number of fish entrained was 1.15 to 4.47 million and that the total number of bull trout could be as high as several thousand. However, since the time of that study, operations and discharge schedules have changed. Adult bull trout marked with floy tags in the Wigwam River system (upstream of Lake Koocanusa) have also been documented to pass through Libby Dam. One fish was subsequently recaptured alive in O'Brien Creek, at least 55 kilometers (34 miles) downstream of Libby Dam (Baxter and Westover 2000). Two others were found dead in the Kootenai River downstream of the dam.

In 1978, a selective withdrawal system was installed at Libby Dam (MBTSG 1996c). Selective withdrawal results in little or no thermocline formation in Lake Koocanusa. The absence of a thermocline may contribute to entrainment of fish. Currently, the fisheries sampling program is not designed to identify affects of operations on use of the reservoir by bull trout. The impact of existing dam operations on bull trout represents a major research need.

Impoundment of the Kootenai River by Libby Dam in 1972 also altered the aquatic environment in the river downstream of the dam. The operation of Libby Dam by the U.S. Army Corps of Engineers departs drastically from natural downriver discharge patterns on a seasonal and sometimes daily basis. After the dam was built, temperature patterns, sediment loads, and water quality were altered downstream of

Libby Dam. These alterations resulted in changes in periphyton, aquatic insects, and fish populations (MFWP 1983). Maximum discharge through the existing turbines is about 792.4 cubic meters per second (28,000 cubic feet per second). Daily peaking of flows has been identified as another issue of concern in the river downstream. Gas supersaturation, which can cause gas bubble disease in fish, is a problem when spilling occurs; but spill has not occurred in over a decade. Collectively, these changes in river ecology as a result of dam operations have had variable and largely unquantified impacts on downstream habitat for juvenile bull trout and their food supply.

Since dam construction, lack of seasonal peak flows has been allowing delta formation at the mouths of some tributaries in Montana and Idaho. These depositional areas may eventually impede upstream movement of bull trout spawners during low flows. Migrant bull trout may be especially sensitive because their fall spawning run coincides with low tributary flows and reduced water depths. A delta at the mouth of Quartz Creek is of particular concern because of that stream's importance to migratory bull trout reproduction. Studies completed in 1988 concluded that this delta did not represent a barrier, but the delta should be monitored periodically to determine whether the surface elevation is increasing (Marotz *et al.* 1988).

Troy Dam, constructed in 1917 at the mouth of Lake Creek, is an upstream fish passage barrier. The dam is located at the site of a natural waterfall suspected to have been at least a seasonal barrier to fish passage. The Bull Lake bull trout secondary core area population is isolated upstream of this barrier and is supported by spawning and rearing habitat within the Lake Creek drainage, especially in Keeler Creek.

Forestry Management Practices

Forestry practices rank as a high risk in this recovery unit, largely because forestry is the dominant land use in the basin. The risk to bull trout is elevated due to the fragmentation in the drainage caused by Libby Dam. Virtually all drainages supporting bull trout in the Kootenai River Recovery Unit are managed timberlands.

In the upper Kootenai River basin, upstream of Libby Dam, both the Grave Creek and Wigwam River drainages are largely second-growth forest, and timber

harvest continues. Extensive road construction has resulted in increased water and sediment yields (MBTSG 1996c). At the present time, within the United States portion of the basin, only the headwaters of the Grave Creek drainage are protected from future timber management activities.

In the Elk River watershed in British Columbia (a tributary to the upper end of Lake Koocanusa), sediment from roads and logging sites was once so severe that water quality investigators felt that settling basins may be needed to protect the stream's water quality. New logging practices in British Columbia, conducted under the current Forest Practices Code, are much more stringent than they were 25 years ago (Westover, *in litt.*, 1999). However, high-water events continue to cause sedimentation. New timber harvest and road building underway in the Wigwam River watershed are of major concern because this watershed currently provides high-quality bull trout habitat. The new activities are being monitored closely, with data to be collected on flows, suspended sediment, temperature, and ground water, both before activities begin and into the future (Westover, *in litt.*, 1999).

There are extensive private timberlands in the upper Kootenai River watershed in the United States, mostly owned by Plum Creek Timber Company (formerly timberlands of Champion International). Much of this land has been heavily roaded and logged, particularly in the Fisher River drainage and the Lake and O'Brien Creek watersheds (MBTSG 1996c). These lands are now covered under the Native Fish Habitat Conservation Plan, which the U.S. Fish and Wildlife Service agreed to with Plum Creek Timber Company in 2000, and habitat for native fish is expected to improve under that agreement.

According to the Environmental Impact Statement for the Kootenai National Forest Plan, almost two-thirds of the Kootenai National Forest in Montana, particularly the west half, has problems with watershed instability. Frequent flooding and concentrated high water yields, sedimentation, and small slumps occur below clear-cuts and roads (MBTSG 1996a). The Montana Department of Health and Environmental Sciences (MDHES 1994) lists 12 streams, over 322 kilometers (200 stream miles) in the Kootenai River drainage as having impaired water quality as a result of timber harvesting.

The channel of Keeler Creek, in Montana, is in a destabilized condition because of extensive timber harvest activities and poorly constructed roads, built primarily between 1941 and 1970 (MBTSG 1996c). During that period, over 100 million board feet were clear cut from 23 square kilometers (5,780 acres). Serious flooding occurred in 1974 and 1980. The Montana Department of Health and Environmental Sciences (MDHES 1994) states that 10.9 kilometers (6.8 miles) of Keeler Creek suffers impaired water quality as a result of silvicultural activities.

A point source of sediment pollution exists on Therriault Creek Road, in the Tobacco River drainage, due to improper road drainage and fill slope construction along the stream channel. Edna Creek, tributary to Fortine Creek, has heavy accumulations of sediment in the stream channel (Marotz *et al.* 1988).

A review of the National Forest database for portions of the Kootenai River basin in Idaho (PBTTAT 1998) revealed that in watersheds important to bull trout, road density averaged 1.5 kilometers per square kilometer (2.4 miles per square mile), with roads covering 1.7 kilometers per square kilometer (2.8 miles per square mile) of riparian area and with 1.1 road crossings per kilometer of stream. A total of 16 percent of the watersheds had been logged. Zaroban *et al.* (1997) found that Idaho Forest Practice Act rules were implemented 97 percent of the time, and when applied, they were 99 percent effective at preventing pollutants from reaching a stream (PBTTAT 1998). However, in half the timber sales reviewed, sediment was still being delivered to streams.

Current forestry practices are less damaging than past practices were, but the risk is still high because of the existing road system, mixed land ownership, lingering results of past activities, and inconsistent application of best management practices (MBTSG 1996c).

Livestock Grazing

While there may be site-specific impacts, aquatic habitat degradation due to improper livestock grazing is not considered a widespread problem in this recovery unit,

in either the United States or British Columbia. Where localized impacts occur, these should be addressed.

Agricultural Practices

The Montana Department of Health and Environmental Sciences (MDHES 1994) lists six streams (135 kilometers [84 miles]) in the upper Kootenai River watershed in Montana as having impaired water quality as a result of agriculture.

There are at least two irrigation diversions in Grave Creek. The North Fork of Grave Creek is actually an irrigation ditch and requires occasional work within the stream channel to maintain suitable flow conditions. The Glen Lake Ditch has lacked any functional fish screening, and bull trout moving downstream were historically lost into this irrigation ditch, some ending up in Glen Lake (MBTSG 1996c). In 2001, a project to stabilize the structure, screen the ditch, and improve fish passage over the dam was completed. The diversion still results in some dewatering of the mainstem of Grave Creek in certain years. Dewatered streams in the upper Kootenai River drainage include Grave, Phillips, Sinclair, and Therriault creeks—a total of 22.5 kilometers (14 miles) of streams (MFWP 1991).

In the Idaho portions of the Kootenai River valley, channel straightening, diking, and creation of drainage ditches have grossly modified and/or eliminated some of the lower tributary and mainstem river habitat (PBTAT 1998; USFWS 1999). Practices that contribute to decreased water quality and/or temperature increases in the lower river corridor could hinder fish use of this river as a migratory corridor and rearing habitat. A problematic diversion on Boundary Creek in Idaho is being screened to eliminate the entrainment of juvenile and adult bull trout. Additional diversion issues may exist on Long Canyon Creek.

Agricultural practices have not had major impacts in the upper Kootenay River watershed in British Columbia, as most of the lands are forested.

Transportation Networks

Five open pit coal mines occur in the Elk River drainage in British Columbia. The major water quality problems associated with these coal fields are nitrogen residuals from bulk explosives and increased delivery of suspended sediment to the Elk River and its tributaries. In recent years, better runoff collection systems have been installed, along with settling ponds, and chemical flocculents are selectively used at the mines. Under permit stipulations, suspended sediment concentrations in effluents are not to exceed 50 milligrams per liter (50 parts per million) (MBTSG 1996c). Impacts are likely to continue on a localized scale. In 1995, it was discovered that selenium was being released from the weathering of large accumulations of waste rock at the mines (McDonald and Stroscher 1998). To date, studies on trout embryos from sites near the mines have found none of the toxic effects often associated with bioaccumulated selenium (Kennedy *et al.* 2000). Additional concerns have been expressed over presence of heavy metals. The mines are located over 96.6 kilometers (60 miles) from the Kootenay River, in the Elk River drainage upstream of a passage barrier at Elko. Overall, current mine impacts to bull trout in the upper Kootenai River may not be significant, but the potential for future problems remains.

Historically, mining was much more active in the Kootenai River drainage than it is today. Underground mining began in the Kootenai River basin in the late 1800's, and large-scale surface mining flourished beginning in the late 1960's. Some small private mining operations continue in the Lake Creek drainage and in Canada. Lake and Stanley creeks (a total of 25 kilometers or 15.4 stream miles) suffer from impaired water quality as a result of mining activities (MDHES 1994). Water quality impairment in Lake Creek is the result of a copper and silver mine, mill, and tailings impoundment owned by ASARCO, Inc. (MBTSG 1996b). This facility is not presently in operation, and operations are not likely to resume due to limited ore reserves at the site.

Acid mine drainage from the Snowshoe Mine in the Libby Creek drainage has affected trout populations in 5 kilometers (3 miles) of Snowshoe Creek and 24 kilometers (15 miles) of Big Cherry Creek for over 70 years (MBTSG 1996a). Efforts are currently underway to reclaim this site, but other abandoned mines need similar attention (MBTSG 1996a). Historic mining operations in the Fisher River drainage have contributed to channel degradation. A total of 40 kilometers (25 miles) of Big Cherry, Libby, and Snowshoe creeks suffer from impaired water quality as a result of mining

Railroads are located along the middle portion of the Kootenai River and along the Fisher River. The rerouting of the Great Northern Railroad in the late 1960's shortened the stream channels of the Fisher River, Wolf Creek, and Fortine Creek by over 3 kilometers (0.6 miles) (MBTSG 1996a). Major portions of the lower 16 kilometers (10 miles) of the Fisher River and most of Wolf Creek were channelized.

On portions of Pleasant Valley Fisher River, the main Fisher River, and Swamp Creek east of Libby, there are straightened and riprapped channels along U.S. Highway 2. This highway also parallels the Kootenai River further west. The potential for negative impacts to bull trout to occur as a result of migration barriers, spills, weed suppression, fire suppression, and road maintenance is high (MBTSG 1996a).

Transportation corridors also occur along portions of the drainage in British Columbia, but their overall impact to habitat on the Kootenai River system has not been extensive.

Mining

Annual discharges from the Cominco, Ltd. phosphate plant in Kimberly, British Columbia, exceeded 7,257,472 kilograms (8,000 tons) of phosphorous in the middle to late 1960's (MBTSG 1996c). Pollution abatement measures were installed in 1975, and the plant eventually closed in 1987. Phosphorus levels in Lake Koocanusa are now much lower. High fluoride levels also existed in the Kootenai River prior to the early 1970's.

The Sullivan Mine, at Kimberly, British Columbia, has been in operation since 1900. Until 1979, acid mine drainage and heavy metals from the mine and concentrator were discharged untreated into Mark, Kimberly, and James creeks, tributaries of the St. Marys River (MBTSG 1996c). This discharge negatively affected fish and aquatic life in the these tributaries, as well as in the Kootenay River itself. Wastewater treatment facilities were installed in 1979, significantly decreasing the quantity of heavy metals reaching the Kootenay River (Kootenai River Network 2000). The Sullivan Mine is scheduled to close in the next few years (Westover, *in litt.*, 1999).

activities (MDHES 1994). Several other drainages in the basin have historical impacts from small mining operations.

In Idaho, Boulder Creek and Blue Joe Creek have a legacy of water- quality and habitat degradation problems from mining activity (PBTTAT 1998). Blue Joe Creek experiences episodes of toxic runoff from the Continental Mine.

A large copper and silver mine complex has been proposed in the Libby Creek watershed, with potential impacts on Little Cherry Creek, which may contain a local population of genetically pure native redband trout (MBTSG 1996a). This Noranda proposal is not currently active; it will require consultation for potential impacts to bull trout under section 7 of the Endangered Species Act if it is revived. Because of risks from historic mines and proposed future mines, the historic/current and restoration risks of mining are rated as high in the Kootenai River drainage.

Residential Development

Many of the streams in this area, particularly in the lower Kootenai River basin, flow through private land. The human population in areas around Eureka, Libby, and Troy, Montana; around Bonners Ferry, Idaho; and in portions of southern British Columbia is increasing, resulting in increased housing development along streams. Development exacerbates temperature problems, increases nutrient loads, decreases bank stability, alters instream and riparian habitat, and changes hydrologic response of affected watersheds. Because of the proximity of this development to stream channels and adjacent to bull trout spawning and rearing habitat, rural residential development is considered to be a risk. The location of the development and not the magnitude is of primary concern at this time for bull trout recovery.

Fisheries Management

Illegal harvest has been well documented in this recovery unit and is considered a high risk to bull trout recovery because of the well-known and limited spawning areas (MBTSG 1996a, 1996b, 1996c). Poaching activity peaks during summer months when fish are in the tributaries and can be easily taken (Long 1997). Using interviews with

convicted poachers in northwest Montana (and northern Idaho), researchers estimated that an average of 22 bull trout per week were harvested from a portion of the Kootenai River in recent years, with additional fish mortally injured but not retrieved (Long 1997). An angler survey on the Elk and Wigwam Rivers in British Columbia estimated that 28 bull trout were illegally taken from these waters in summer 1998 (Westover 1999).

In the late 1960's and early 1970's, just prior to completion of Libby Dam, several tributaries to Lake Koocanusa were treated with toxicants to remove rainbow trout and restore westslope cutthroat trout. These tributaries included Young, Big, Five Mile, Sullivan, and Clarence creeks (MBTSG 1996c). At the time of treatment only Clarence Creek was known to support bull trout.

Brook trout are present in many bull trout spawning and rearing streams in the Kootenai River Recovery Unit. A 25 percent hybridization rate with brook trout was detected from a sample of 24 bull trout collected in the Kootenai River between Kootenai Falls and Libby Dam (MBTSG 1996a). Brook trout are present throughout the upper Kootenay River drainage in British Columbia, although their numbers are generally low and they do not occur in the Wigwam River system. Most brook trout are found in warmer, more heavily impacted streams (Westover, *in litt.*, 1999).

Other introduced fish species found in the Kootenai River drainage include coastal rainbow trout (the kamloops/redband trout are native in the lower Kootenai), Yellowstone cutthroat, kokanee salmon (in Lake Koocanusa), lake trout, northern pike, yellow perch, smallmouth bass, largemouth bass, black bullhead, and pumpkinseed sunfish. *Mysis relicta* (opossum shrimp) have also been introduced into lakes in the drainage. Brown trout were collected in Lake Creek in 1994 and in the Kootenai River downstream of Kootenai Falls in 1998 and 2000. These are the first recorded occurrences of brown trout in the Kootenai River drainage in Montana.

Predation or competition by largemouth bass, northern pike, or other cool or warmwater species could have negative impacts in localized situations. The presence of kokanee salmon in Lake Koocanusa and in the Kootenai River downstream may

benefit bull trout by providing a food source for subadult and adult fish (MBTSG 1996c).

Historically, few private fish ponds existed in the upper Kootenai River drainage. Several unlicensed ponds are known to be present in the Grave Creek drainage (MBTSG 1996c). The Lincoln County Conservation District has received numerous requests for private pond construction permits during the past few years. Many applicants for private pond permits request authorization to stock brook trout. Requests for private fish pond permits are likely to continue to increase along with local human population growth (MBTSG 1996c). Proliferation of private ponds presents a risk to bull trout recovery efforts. In the upper Kootenai River drainage in British Columbia, private fish farms are permitted to raise only rainbow trout and they must be in self-contained artificial ponds on their own property.

Extensive gravel mining occurred when Highway 93 was reconstructed near Eureka. The pits created by this mining have now filled with water, potentially creating habitat for nonnative fish species such as perch and northern pike (MBTSG 1996c). There is a concern that this newly created habitat may exacerbate the spread of some introduced species.

Most nonnative species currently present were intentionally introduced through agency stocking in the last century. Such stocking of brook trout, coastal rainbow trout, and Kamloops rainbow has occurred in the upper Kootenai River drainage (extending the range of the latter, which are native in Kootenay Lake). The kokanee salmon population in Lake Koocanusa resulted from an accidental release of fish from a hatchery in British Columbia in the 1970's (MBTSG 1996c). Presently, coastal rainbow trout are planted only in isolated lakes. All other fish plants in the United States, with the exception of Lake Koocanusa, are with westslope cutthroat trout, which are native to the Kootenai River.

There have been continuing problems across northwest Montana with illegal fish introductions. Illegal introductions have occurred in at least 28 waters in the Kootenai River drainage (Vashro, *in litt.*, 2000), most of which involved warm- or coolwater species (pike, perch, bass, bluegill, bullhead) and most of which occurred or

were only detected in the past 10 years. Two northern pike have been gill netted in Lake Koocanusa (Westover, *in litt.*, 1999). Illegal fish stocking is reportedly a problem on both sides of the border (Westover, *in litt.*, 1999). A lake trout was documented for the first time in an angler catch from Kootenay Lake in fall 1999 (Westover, pers. comm., 2001). As with other large lakes, the potential for establishment of a reproducing lake trout population in Kootenay Lake is cause for concern (Donald and Alger 1993; Fredenberg 2000).

Stocking programs on either side of the international border have the potential to negatively impact Kootenai River bull trout if the introduced species emigrate and become established. The Province of British Columbia stocks brook trout only in landlocked lakes in the upper Kootenai River drainage (Westover, *in litt.*, 1999). High-elevation lakes are stocked with westslope cutthroat trout. Some low-elevation lakes in the lower Kootenay River drainage are stocked with rainbow trout. Fisheries management programs in Canada are outside our jurisdiction, but close communication and collaboration has occurred in the past and must be continued.

In recent years, the fisheries management emphasis in the United States portion of Lake Koocanusa has switched from westslope cutthroat trout to Kamloops rainbow trout (MBTSG 1996c). Lake Koocanusa is being stocked with Kamloops rainbow trout in United States waters in hopes of providing a trophy fishery sustained by the kokanee salmon forage base, circumstances similar to those occurring naturally downstream in Kootenay Lake. The extent of interactions between Kamloops and bull trout, two large, piscivorous species, are unknown. However, anecdotal evidence from Kootenay Lake, British Columbia, and Lake Pend Oreille, Idaho, indicates they are compatible in the presence of an abundant kokanee forage base. Anglers in British Columbia have reported catching hatchery-reared rainbow trout (Westover, *in litt.*, 1999), and the potential impacts of these plants on remaining westslope cutthroat trout need to be further evaluated.

Angling techniques that are effective on Kamloops rainbow trout are likely to also be effective on bull trout, raising concerns about incidental capture and hooking mortality if a demand for a Kamloops fishery in Lake Koocanusa is created (MBTSG 1996c). Drainages that receive high fishing pressure are more likely to experience

hooking mortality loss, especially when anglers target larger fish. Based on mail surveys, estimated fishing pressure in Lake Koocanusa was 29,224 angler days in 1993 (MFWP 1994), but by 1999 fishing pressure had nearly doubled to an estimated 57,493 angler days (MFWP 2000); the lake is the most heavily used lake in western Montana.

Currently, in British Columbia, anglers are allowed to harvest one bull trout per day from Kootenay Lake and Lake Koocanusa (Westover 1999). Bull trout caught in most tributaries to these waters must be released. Between April 1 and October 31, anglers are allowed to keep one trophy bull trout (over 70 centimeters [27.6 inches]) per day in the lower Elk River and one bull trout per day from the Kootenay River. There is also a summer bait ban and a year-round single barbless hook restriction in these rivers. Parnell (1997) estimated only 23 bull trout were harvested from the Canadian portion of Lake Koocanusa in nearly 27,000 angler days between June 1 and September 21, 1996. This low rate of harvest is not believed to present a problem for bull trout recovery.

Kootenay Lake, British Columbia, has been supplemented with commercial fertilizer since 1992, following an intensive investigation that concluded such a program would partially compensate for declining productivity in the fishery due to the loss of nutrients. Declining nutrient loads were correlated with lower in-lake nutrient concentrations, chlorophyll *a* concentrations, and macrozooplankton densities and with a dramatic decline in kokanee salmon stocks (Thompson 1999). Nutrients were applied at the north end of the lake, and the response of the food web was monitored. Models predicted that increased zooplankton production resulting from fertilization might be shunted into increased abundance of *Mysis relicta*. In fact, *Mysis relicta* abundance decreased during the experiment. Kokanee abundance increased fourfold, and populations of Gerrard rainbow trout also increased. Thompson (1999) was unable to obtain an estimate of bull trout abundance in Kootenay Lake, but stated that tributary surveys found as many as 200 bull trout (presumably adult spawners) in some tributaries and suggests that the bull trout population may be increasing in a trajectory similar to Gerrard rainbow as a result of improved forage (especially kokanee). Olmsted *et al.* (2001) estimated over 500 adult bull trout from Kootenay Lake congregated annually in 1995 to 1997 below Duncan

Dam, a structure blocking upstream access to spawning areas in the upper Duncan River. British Columbia Hydro successfully passed most of those fish over the dam.

The harvest of bull trout is no longer legal in the Kootenai River drainage in the United States. However, there is still some risk to bull trout from incidental hooking and handling mortality. A fishery for large rainbow trout is becoming more popular in the Kootenai River, and many of the techniques used by those anglers are also effective on bull trout. The Kootenai River in Montana received an estimated 37,491 angler days of fishing pressure in 1999, up from 25,213 angler days in 1991 (MFWP 1992, 2000).

For Bull and Sophie lakes, anglers have expressed strong support for attempts to improve the fishery with nonnative fish. Largemouth bass are well established in Bull Lake, and their interaction with bull trout is unknown (MBTSG 1996b). Northern pike and bluegill were illegally introduced in Sophie Lake in the past decade and have become well established (Vashro, *in litt.*, 2000). The northern pike population appears to have grown dramatically in recent years.

Lake trout are present in Spar Lake, which is a closed basin lake (MBTSG 1996b) located adjacent to Bull Lake and in the same drainage. Northern pike are present in some other valley lakes and in backwater areas of the Kootenai River. Both lake trout and northern pike are potential predators on, and competitors with, juvenile bull trout. Although their distribution in the drainage is presently limited, lake trout, if they become established in the Kootenai River/Kootenay Lake system, could pose a major threat to bull trout. Interactions of bull trout with many other introduced species are presently unknown. Future sport fishery management directed at improved recreational fishing for introduced species has the potential to conflict with the goal of restoring bull trout in portions of this drainage (MBTSG 1996c).

Isolation and Habitat Fragmentation

There are two components to the risk from environmental instability. First is the likelihood that a catastrophic event could occur. Second is the risk to bull trout if such an event occurred. The Kootenai River drainage is at a relatively high risk from

environmental instability due to climate, geology, and aspect (MBTSG 1996a, 1996b, 1996c; PBTAT 1998). This area receives high annual precipitation and frequent rain-on-snow events. Rain-on-snow is a common term used to describe cloudy weather periods when warm winds and rain combine to produce rapid snowmelt. These events generally occur during early to midwinter periods. Much of the bull trout spawning and rearing habitat in the Kootenai River drainage is in watersheds with unstable soils and steep slopes. Extensive bedload aggradation combined with low flow conditions can result in dewatering. Seasonal loss of surface flow is evident within aggraded reaches of the Libby, Callahan, and Keeler Creek watersheds (MBTSG 1996a, 1996b). Several landslides have occurred in the Wigwam River drainage (Westover, *in litt.*, 1999), sometimes extending entirely across the river downstream of Lodgepole Creek in British Columbia. A poorly timed or extremely large slide could potentially block spawning access to this critical tributary.

Rieman and McIntyre (1993) concluded that temperature is a critical habitat variable for bull trout. Temperatures in excess of 15 degrees Celsius (59 degrees Fahrenheit) are thought to limit bull trout distribution in many systems (Fraley and Shepard 1989; Brown 1992). In Libby Creek, summer water temperatures as high as 22 degrees Celsius (72 degrees Fahrenheit) and 27 degrees Celsius (81 degrees Fahrenheit) were recorded during 1992 and 1994, respectively (MBTSG 1996a). The Fisher River is also known to have elevated water temperatures (MBTSG 1996a).

Natural thermal limits to bull trout distribution are suspected at several locations. For example, Fortine Creek joins Grave Creek, forming the Tobacco River. Fortine Creek drains mostly low-elevation lands. Summer maximum water temperatures in Fortine Creek greatly exceed those recorded in Grave Creek, which drains high-elevation lands along the Whitefish Divide. Grave Creek is the only bull trout spawning and rearing habitat for this core area that is situated entirely in the United States, and the Tobacco River provides the migratory corridor linking it to Lake Koocanusa. Concerns exist that the migratory corridor of the Tobacco River may be compromised by the thermal input of Fortine Creek (MBTSG 1996c).

Water temperatures are probably limiting to bull trout in many Idaho tributaries (PBTAT 1998), particularly those in watersheds that have natural

barriers that block access to the upper drainage (*e.g.*, Moyie River). All are low-elevation streams, and many may not have been hospitable for bull trout, even historically.

If a local population is small enough, variations in survival can cause a declining population for a period long enough that it can be extirpated (Rieman and McIntyre 1993). The local bull trout population in Bull Lake is estimated at several hundred fish or fewer (MBTSG 1996b). Sophie Lake covers only about 81 hectares (200 acres), and bull trout spawn and rear only in Phillips Creek (MBTSG 1996c). The number of adult bull trout is probably fewer than 100 fish. Both of these secondary core areas are at high risk due to their small size, isolation, and restricted habitat.

ONGOING RECOVERY UNIT CONSERVATION MEASURES

Over most of the last decade, significant planning efforts to restore and recover bull trout have been initiated, and many on-the-ground activities that were specifically designed to benefit bull trout and other native salmonids within the Kootenai River Recovery Unit have been implemented. Ultimately, the measure by which these efforts should be judged is the degree to which they have produced positive response in adult abundance and security of local bull trout populations. However, because most of these efforts are relatively young, and would not be expected to produce measurable population response for perhaps several bull trout generations, it is premature to judge the success of most of those programs. Following is a brief summary of the existing and ongoing conservation activities, by jurisdiction:

State of Idaho

The Idaho Department of Fish and Game developed a management plan for bull trout in 1993 (Conley 1993), and the State of Idaho approved a strategy for the conservation of bull trout in July 1996 (Batt 1996). The overall approach is to accomplish bull trout recovery by enlisting the support of existing groups established by Idaho legislation, *i.e.*, watershed advisory groups and basin advisory groups that were formed to strengthen water quality protection and improve compliance with the Clean Water Act through locally developed, site-specific programs.

Under this process, the Kootenai River was designated as 1 of 59 key watersheds in the State of Idaho. The Panhandle Basin Bull Trout Technical Advisory Team produced a working draft of the Kootenai River basin bull trout problem assessment in December 1998, but has not met since that time. The existing draft contains background information, but few specific recovery actions. The process for the Idaho basin advisory group and the watershed advisory group, as it pertains to bull trout planning, is currently on hold, pending further direction from the Governor's staff.

State of Montana

Beginning in 1990, the State of Montana initiated several bull trout planning activities. The State also increased law enforcement efforts and habitat restoration and habitat monitoring actions. In 1993, the Governor of Montana appointed the Bull Trout Restoration Team to produce a plan that maintains, protects, and increases bull trout populations. The team appointed a scientific group to provide the restoration planning effort with technical expertise.

The scientific group wrote 11 basin-specific status reports and 3 technical, peer-reviewed papers; the latter concerned the role of hatcheries (MBTSG 1996d), suppression of nonnative fish species (MBTSG 1996c), and a strategy for land management (MBTSG 1998). A draft restoration plan that defined and identified strategies for ensuring the long-term persistence of bull trout in Montana was released for public comment in September 1998 (MBTRT 1998). In June 2000, the final restoration plan was issued (MBTRT 2000). The plan synthesizes the scientific reports and provides recommendations for achieving bull trout restoration in western Montana. It focuses activities on 12 restoration and conservation areas and was designed to complement and be consistent with this Bull Trout Recovery Plan. The Montana restoration plan relies on voluntary actions, keyed by watershed groups, but has no legislative or legal authority beyond existing State law. Implementation of the Montana restoration plan is expected to mesh with implementation of this recovery plan.

A multitude of habitat restoration projects, such as removing fish passage barriers, screening irrigation diversions, fencing riparian areas, restoring stream areas, and monitoring habitat, have been completed or are underway in Montana (Graham and Clinch, *in litt.*, 1999). Angling regulations have become more restrictive than in the past, brook trout are no longer stocked, and ongoing genetic studies are being conducted. In addition, as in Idaho, these activities are being carried out cooperatively by a broad group of State, Federal, and Tribal agencies and private entities with multiple sources of public and private funding.

Several significant funding sources with money available for bull trout restoration have been developed in Montana. The Montana Future Fisheries Improvement Program awards approximately \$750,000 annually for projects that restore or enhance habitat for wild fish, with preference given to those projects that emphasize native species. House Bill 647, passed in the 1999 Montana Legislature, roughly doubled the annual funding for such projects with specific directives to benefit bull trout and cutthroat trout. The State of Montana also receives approximately \$1 million annually from Bonneville Power Administration, through the Northwest Power Planning Council, for native fish restoration work. Collectively, these and other funding sources provide a solid foundation upon which to implement many of the actions described in the narrative portion of this recovery plan.

Federal Activities

In addition to standard land and water management guidelines and the Endangered Species Act guidelines that apply to Federal actions in the Columbia River basin (see Chapter 1), there have been several significant Federal efforts with specific implications to bull trout in the Kootenai River Recovery Unit. The U.S. Fish and Wildlife Service has negotiated a Habitat Conservation Plan with Plum Creek Timber Company. This Habitat Conservation Plan includes bull trout and other native salmonids on about 6,500 square kilometers (over 1.6 million acres) of corporate lands, a portion of which are within the Kootenai River Recovery Unit. A Final Environmental Impact Statement was published in September 2000, and the Habitat Conservation Plan was signed in December 2000. Successful implementation of the Habitat Conservation Plan will result in additional conservation of private timberland and improved grazing management practices, including reducing impacts of future actions and remediating existing problems to benefit bull trout.

In 2000, impoundment and operation of Libby Dam on the Kootenai River was included in the formal Endangered Species Act section 7 consultation for the Columbia River Power System. Included in the Biological Opinion were evaluation of factors pertaining to the recovery of the endangered Kootenai River white sturgeon, as well as downstream salmon and steelhead stocks (USFWS 2000). Under the section

on Reasonable and Prudent Measures, the Biological Opinion calls for the following at Libby Dam:

Implement operational constraints [that are] intended to minimize adverse effects of rapid and severe flow fluctuations on bull trout, including year-round minimum flows and ramping rates, seasonal water management, conducting studies to monitor the adequacy of the constraints, and providing for modification of the operational constraints depending on study results (USFWS 2000).

The objective of this measure is to minimize take of bull trout resulting from dam operations (USFWS 2000). The Biological Opinion includes specific flow targets and ramping rates and mandates implementation of VARQ (or variable-flow flood-control) operations to better balance reservoir refill and downstream flow regimes. If implemented, the changes are expected to benefit bull trout and other native fishes, especially Kootenai River white sturgeon (USFWS 2000). Flow regimes from Libby Dam will probably continue to be modified in the future through adaptive management changes.

The Northwest Power Act, in part requiring mitigation for past and present impacts to fish and wildlife from Federal hydropower dams such as Libby Dam, has been successfully used to direct Bonneville Power Administration funds to a series of fisheries recovery actions in western Montana, northern Idaho, and, to a lesser extent, in British Columbia. These projects will benefit bull trout and other salmonids. With the Endangered Species Act listings of bull trout and Kootenai River white sturgeon, a larger portion of those funds are now being spent on actions directly related to recovery for those species.

The U.S. Fish and Wildlife Service has established several staff positions in western Montana under the Partners for Fish and Wildlife Program. Most of the new staff's effort has been directed at developing partnership opportunities and directing Federal funds toward cooperative habitat restoration, water development, and easement programs to benefit native fish in prescribed focus areas. The Kootenai River drainage in Montana is one of the focus areas. Examples of the benefits of this

effort include the program currently underway to restore habitat and reduce entrainment loss in the Grave Creek drainage.

Canadian Government Activities

The Province of British Columbia has dedicated resources to the protection of the Kootenay River drainage, including research and management efforts to protect the upper Kootenay River bull trout spawning and rearing habitat for migratory fish from Lake Koocanusa, and efforts to reverse the decline of the fishery downstream in Kootenay Lake. The Province is actively managing and evaluating the bull trout populations and spawning runs from Lake Koocanusa into the upper portions of the Kootenai River drainage. The Province has also implemented and enforced stricter angling regulations to accommodate United States concerns and they continue to cooperate in recovery planning efforts. For example, in 1995, British Columbia angling regulations were changed to eliminate legal harvest of bull trout and to allow only catch and release for streams in the entire Elk River drainage, including the Wigwam River system (Westover, pers. comm., 2001).